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Rear Admiral Bartholomew W. Hogan MC USN - Surgeon General
Captain Leslie B. Marshall MC USN (RET) Editor

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HISTORICAL FUND
of the
NAVY MEDICAL DEPARTMENT

A committee has been formed with representation from the Medical Corps, Dental Corps, Medical Service Corps, Nurse Corps, and Hospital Corps for the purpose of creating a fund to be used for the collection and maintenance of items of historical interest to the Medical Department. Such items will include, but will not be limited to, portraits, memorials, etc., designed to perpetuate the memory of distinguished members of the Navy Medical Department. These memorials will be displayed in the Bureau of Medicine and Surgery and at the National Naval Medical Center. Medical Department officers, active and inactive, are invited to make small contributions to the fund. It is emphasized that all donations must be on a strictly voluntary basis. Funds received will be deposited in a Washington, D. C. bank to the credit of the Navy Medical Department Historical Fund, and will be expended only as approved by the Committee or its successor and for the objectives stated.

It is anticipated that an historical committee will be organized at each of our medical activities. If you desire to contribute, please do so through your local historical committee or send your check direct, payable to Navy Medical Department Historical Fund, and mail to:

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The Navy Tissue Bank

Physical trauma creates a tremendous demand for the replacement of destroyed tissues. Grafting of tissue—bone or skin—is not a new procedure. It has been done with varying degrees of success since the seventeenth century. Heterografts—removal of tissue from one species and transplanting it to another—probably were the first kind of grafts to be used. Autograft—tissue removed from one site on a patient's body and grafted to another—is, when clinically feasible, the method of choice. Nowadays, the homograft, that is, removing tissue from one individual for subsequent grafting to another, is frequently used.

Homografts are used to replace a tissue whose function is decreased by either disease or trauma. Some specific uses of the homografts are: arteries for aneurysms, bone for fusions, cartilage for rhinoplasties, dura for dural defects, fascia for defects of the chest wall, and skin for the treatment of burns.

Many surgeons believe that the physiologic price that the patient pays for an autograft is entirely too expensive when the homograft accomplishes a comparable, although not identical, return at less physiologic cost. This is especially true when the surgical risk is tremendously increased if the patient is a child or an elderly person. This makes it imperative to develop methods to procure, process, bank, and dispense homografts for clinical use and for research.

In 1949, the Navy Tissue Bank was started at the Naval Medical School, National Naval Medical Center in Bethesda, Md. This was the first tissue bank where various types of tissues were procured, processed, banked, dispensed, and clinically evaluated as homografts. In the past 10 years, personnel assigned to the tissue bank have continued to study and improve methods of preserving various types of grafts and to evaluate the success of their use.

The principal source of tissue is a recently deceased person on whom a sterile postmortem procedure is performed. Specific criteria must be observed in the selection of a donor. There must be no evidence of malignancy or transmissible disease, and the body must be received within 24 hours after death. Legal permission must be granted by the next of kin following the death of the patient. When these criteria are fulfilled, an officer from the tissue bank talks with the family, explains the procedure and the uses for homografts, and requests permission to excise certain tissues. No patient is ever asked for tissue donation.

The initial processing of tissue for preservation is started immediately after removal. All homografts are cultured for aerobic and anaerobic contaminants before they are deposited in the Tissue Bank.

For the initial processing of all tissues except cartilage and skin (unless freeze-dried), 85% Ringer's solution is used to which is added 500 thousand units of aqueous penicillin G and 0.5 gm. of streptomycin per liter.

Skin. Split-thickness skin is placed in a nutrient medium of balanced saline solution with 10% pooled human serum, 500 thousand units of aqueous penicillin G, and 0.5 gm. of streptomycin per liter. Phenol red is added to indicate pH range. If the phenol red indicates pH change, up to 50% of the medium may be replaced with fresh medium.

Skin is also treated by the glycerol-Ringer method. It is placed in a beaker containing 15% glycerol, 85% Ringer's solution, 500 thousand units of aqueous penicillin G, and 0.5 gm. of streptomycin per liter. After an hour in this solution, the skin is ready for further processing. Perforated cellophane is soaked in the solution and squeezed dry. An arbitrary length of cellophane is then laid down on a sterile surface and segments of the impregnated skin are smoothed on top of the cellophane. Another layer of cellophane is placed on top of the skin and more skin is smoothed upon it. This process is continued until approximately 500 square centimeters of skin are so placed. This constitutes one homograft deposit. The deposit is put in a Pyrex test tube. The tube is immersed in 95% ethanol-carbon dioxide slush at minus 76° C. for 15 minutes for rapid freezing. Utmost precaution must be taken that none of the carbon dioxide slush comes in contact with the homograft. After freezing, the grafts are stored in a dry ice chest.

If the skin is to be freeze-dried, it is rinsed in Ringer's solution containing the same amounts of antibiotics as previously mentioned. After rapid freezing, deposits are put in one sterile wrapper and stored at minus 76° C.

Fascia lata. Following excision, fascia lata is rinsed in the solution and then pinned on a Teflon covered board. All extraneous soft tissue is removed by dissection. When this is accomplished, the tissue is measured, placed in a Pyrex test tube, cultured, and rapidly frozen in the same manner as skin. The tubes are wrapped in sterile double muslin covers and stored in dry ice at minus 76° C. to await further processing.

Arteries. After rinsing in balanced saline solution, these homografts are dissected free of any remaining connective tissue. The vessels are measured, exact drawings made of each artery, cultures are taken, and the vessels are placed in a sterile glass jar filled with nutrient medium. They are stored at 4° C. to await culture reports. If the bacteriologic reports are negative, each homograft is then placed in a Pyrex test tube and rapidly frozen. These tubes are also wrapped in sterile double muslin before storing in dry ice. If an artery is contaminated, it is sterilized in ethylene oxide or beta propiolactone.

Dura Mater. The dura is rinsed in the Ringer's solution containing the antibiotics. It is then measured, cultured, placed in a Pyrex tsst tube, rapidly frozen, and processed in the same manner as fascia lata.

Cartilage. The costochondral cartilage is scraped free of soft tissue, cultured, and soaked in an aqueous solution of stainless merthiolate 1 to 1000. It is recultured in 14 days. After this interval, it is ready for clinical use. Resoaking and reculturing are not indicated unless the solution becomes turbid.

Bone. As each bone is removed, it is wrapped in a sterile towel and taken to the processing room. On a sterile draped table the soft tissue is removed. The long bones are cut into strips by use of a bone saw. The ilia are either sawed into dice-sized fragments, ground in a bone mill, or cut into cancellous strips. Ribs are cut into segments called "match sticks." Each graft is cultured for aerobic and anaerobic contaminants. Culturing is done by swabbing the surfaces with saline moistened cotton-tipped applicators. Bacterial safety of the ground cancellous bone is determined by placing a fragment into the bacterial culture medium.

The bone homografts are then washed in Ringer's solution with the added antibiotics. Each graft is then placed in a sterile bottle plugged with gauze. Each bottle is labeled with a numbered metal band, wrapped in sterile double muslin wrappers, and stored in a dry ice freezer. Culture reports are received in 4 days and those grafts reported as "No Growth" are then freeze-dried.

Freeze-drying is the removal of moisture from a frozen substance in a vacuum. At the Tissue Bank, a commercial freeze drier that has been modified to serve the purpose is used.

Before the process is started, the freeze drier is sterilized by spraying it with dichloran. Trichlorethylene circulates through the coils and is cooled by the ethanol and carbon dioxide slush in the external cooler. The cooled trichlorethylene then lowers the temperature of the upper shelf to minus 45° C. Using sterile technique, the bottles of homografts are removed from the dry ice chest, quickly unwrapped, and placed on the upper or the "Tissue Shelf." The door gasket is coated with silicone lubricant and securely closed; the vacuum pump is turned on. Pressure maintained at 5 to 10 microns of mercury within the chamber is recorded by a gauge, and temperature by dial thermometer.

The temperature of the upper shelf is allowed to rise gradually to 0° C. in 24 hours by closing the valve to the trichlorethylene, and to 30° C. on the fifth day to supply heat to remove tissue water. However, the temperature of the lower shelves remains at minus 45° C. to trap the water of sublimation. The soft tissue freeze drying cycle is 3 days; 14 days are required for bone and cartilage.

The pressure in the chamber is gradually increased to atmospheric pressure. The deposits are removed using sterile technique and are vacuum packed by a small hand vacuum pump. The jars are sealed with sealing wax. The material is labeled and checked to be positive that all records, numbers, measurements, and descriptions agree. The homografts are then "banked" at room temperature until they are needed.

The storage time of the freeze-dried homograft is unknown. Tissues have been stored for 7 years and no changes have been observed in them either clinically or grossly.

Before most homografts can be used, they must be rehydrated. To rehydrate a freeze-dried tissue, the sealing wax is removed from the stopper by chipping it off with a sharp instrument and the surface is then cleansed with ether which acts as a solvent for any remaining wax. The rubber stopper is then swabbed thoroughly with alcohol. Enough sterile isotonic saline to completely immerse the homograft is injected through the rubber stopper. Rehydration is facilitated if the vacuum is maintained during injection. Approximately 30 minutes is required for rehydration of soft tissues; cortical bone and cartilage require from 24 to 48 hours to rehydrate. Cancellous bone and rib match sticks need not be rehydrated prior to use as these are readily rehydrated by the recipient's fluids. Glycerol-Ringer frozen tissues are removed from the container, cultured, and then placed in 37° C. isotonic saline for about 20 minutes.

After rehydration of the graft, the rubber stopper is removed from the bottle with a sterile clamp. The tissue is removed by a sterile instrument, and cultured for aerobic contaminants before it is used surgically.

The nurse in the tissue bank is responsible for helping to teach corpsmen to become tissue bank technicians. They must learn and understand all procedures relating to procuring, processing, banking, dispensing, and using homografts. The nurses's position is very similar to that of an operating room supervisor. When a surgeon wants a homograft, it is on hand ready to be dispensed.

As studies and research continue, the nurse plays an active role in helping with the projects, collecting data, and keeping records.
(LT Sarah C. McGinniss NC USN, Naval Medical School, NNMC, Bethesda, Md., The Navy Tissue Bank: American Journal of Nursing, 59: 666-669, May 1959)

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Venereal Diseases Today

The venereal diseases are so called because they are acquired and spread principally through sexual exposure. They are five in number and their frequency in the United States is in this descending order: gonorrhea, syphilis, chancroid, lymphogranuloma venereum, and granuloma inguinale. The last three have been classed as minor venereal diseases because their incidence and prevalence are considerably less than those of gonorrhea or syphilis. In Massachusetts, as well as in the other states, the minor venereal diseases constitute only 0.5 to 1% of the total cases reported. This article summarizes the present state of knowledge of the venereal diseases from the viewpoint of clinical and public health medicine.

In the United States, there was a slow but steady increase in reported cases of gonorrhea and syphilis from 1920 to about 1935. In 1936, the

prevalence of syphilis rose sharply and continued to rise during World War II. This marked increase was due to two factors. The first was the impact of the depression on the family and a relaxation of popular sexual habits. The second and more important factor was the effect of the organized programs of syphilis-oriented venereal disease control in all state health departments. It is understandable that with intensification of syphilis case finding, the morbidity rate for this disease climbed more sharply than that for gonorrhea.

Beginning with fiscal year 1948, however, there was a significant decline in reported cases of syphilis among the civilian population. This drop persisted up to 1956 when the downward trend was reversed. In 1948, 338,141 cases of syphilis were reported, or 234.7 per 100,000 population, whereas at the end of 1955, a total of 122,075 reports of syphilis, or 76.0 per 100,000 were received. This represents a rate decline of 68%. Yet in 1955, syphilis ranked fourth among the reportable infectious diseases, the top three being measles, gonorrhea, and the streptococcal infections, including scarlet fever. But in fiscal year 1956, infectious and total syphilis increased nationally for the first time in 9 years. In fiscal year 1957, cases of syphilis in all stages reported by state health departments increased by 5% above the previous year. In fiscal year 1958, infectious syphilis increased by 5.9% over the previous year. It is interesting that in fiscal year 1951 not a single state showed an increase in primary and secondary syphilis over the previous year, but in the 7 successive years, 1952 through 1958, an increasing number of states showed an increase in infectious-lesion syphilis. During the past year, twenty-three states and the District of Columbia reported an increase in infectious syphilis.

Gonorrhea is the most undiagnosed and under reported of all the venereal diseases, if not of all the communicable diseases. Yet, in spite of this, it ranks second to measles among the reported communicable diseases in the United States. Beginning in 1920, gonorrhea showed a more or less stable rate each year until World War II, when for the first time it showed a significant increase which continued until 1948 when a gradual decline began. Thus, gonorrhea has declined much more slowly than syphilis and in the past 5 years has remained almost stationary.

The venereal diseases are discovered and reported more frequently in males than in females, and in nonwhite than in white people. It is estimated that there are approximately 1,250,000 cases of syphilis in the United States that are in need of treatment, and approximately 1,000,000 fresh cases of gonorrhea each year. Gonorrhea is reported forty times as frequently for the nonwhite as for the white population. The ratio of males to females with gonorrhea is about 2.5:1 for both the white and the nonwhite population. Although there was a greater frequency of reported cases of syphilis among nonwhites than among whites, the ratio was not as great as was seen with gonorrhea—3 among the nonwhite for every 2 among the white population. Whereas, the incidence in nonwhite males and nonwhite females was about the same, white females were named as being infected with syphilis half as

frequently as white males. The variations between males and females and between whites and nonwhites have been attributed to a number of factors: One is the under-reporting of cases among whites and the more complete reporting among nonwhites because Negroes are more apt to go to public clinics. The disparity of rates between the sexes is probably due to the greater ease of diagnosis in males.

The most significant observation is the increase in gonorrhea and infectious syphilis among the teen-age and young adult population during the past 6 years. More than 53% of the reported cases of gonorrhea and syphilis in 1957 were in the group of 15 to 24 years of age; yet this group comprises only about 13% of the total population. During 1957, 22.4% of the total reported cases of infectious venereal disease occurred among teen-agers. Last year, nearly half of the persons involved in venereal disease epidemics in the United States were teen-agers. The reported incidence of infectious venereal disease is highest among females at the age of 18 and among males at 23.

During 1957 in Massachusetts, 61.5% of patients with infectious venereal disease were single, 22.9% were married, and 15.6% were widowed, divorced, or separated. Analysis of the educational status of the patients who came to the twenty-three state cooperating clinics revealed some interesting data: 75% had completed the eighth grade, 22% had finished high school, and 5% had gone beyond high school.

Analysis of the sexual contacts of infectious patients in Massachusetts revealed that about 95% were reported by patients from the twenty-three clinics. Thus, any conclusions from these data would apply only to clinic patients and not to the infected patients of the state as a whole. For the year 1957, it was found that 46.9% of the female sexual partners were pickups, 32.8 were friends, and 9.6% were prostitutes. In 42.4%, the infected men met these girls in a bar or tavern. Exposures took place in a home in 57.6%, in a car in 18.5%, and in a hotel room in 4.0% of the cases.

At the outset, it is important to realize that the venereal diseases connot be eradicated by present control methods alone. Until new and better procedures can be devised, all that clinical and public health medicine can expect is a reduction of these diseases. How much they can be reduced depends directly upon the efficiency of practitioners in both groups. Modern venereal disease control programs are directed essentially at early diagnosis and treatment—that is, finding potential cases, establishing a diagnosis, and treating the infected person. There are three methods of finding these cases: selective mass blood testing, public education, and interviewing and investigation of contacts.

Selective mass blood testing is performed when certain segments of the population undergo a blood test—for example, persons in high-prevalence areas, those about to be married, pregnant women, blood donors, prospective draftees, hospital patients, and patients with skin diseases. Some hospitals

and physicians have stopped doing routine blood tests on new patients and hospital admissions and later are embarrassed to find that syphilis was the cause of the patient's symptoms or existed in addition to some other problem. Patients with symptomatic late syphilis almost invariably could have been discovered before this stage if the blood test had been maintained as a routine laboratory procedure.

Public education is aimed at motivating persons who have exposed themselves to seek early medical care. People need to have accurate information that will be appropriate for their age and cultural status. They should know the early signs and symptoms and the manner in which these diseases are spread, where persons suspecting infection may go for examination, and what constitutes good modern treatment.

Unfortunately, with the exception of the military population, very little popular education is carried out today, principally because of inadequate budgets and insufficient funds for hiring competent professional educators.

Interviewing and investigation of contacts begin with the infected patient. By skill, tact, and persuasion, attempts are made to elicit the names of those to whom the patient was exposed during the time covered by the maximum incubation period as well as those whom the patient had exposed since the onset of the symptoms. Once this information has been obtained, the search for contacts begins; when found, they are examined and treated if infected. Some—particularly female contacts of patients with gonorrhea—are treated prophylactically because of the difficulty in diagnosing gonorrhea in the female. These techniques have obvious limitations and difficulties. Yet no others are available.

Preventive methods offer little hope of eradication because sexual promiscuity is basic to the spread of these diseases. If promiscuity could be reduced or eliminated, the venereal diseases would show a corresponding decline or would disappear entirely. There is little to indicate at this time that the sexual habits of the population will undergo a radical change for the better. Purely mechanical, chemical, or antibiotic prophylaxis—apart from its legal, moral, or social implications—is not particularly effective or useful and has been deemphasized, even by the Armed Forces.

No method of producing artificial immunity against these diseases exists as with vaccination in smallpox or yellow fever. There is no way of attacking the organisms causing the diseases apart from treating the patient. There is no intermediate host. The infectious reservoir lies in the group of missed and undiagnosed cases and treatment failures.

With clinical and public health medicine well organized for early detection and treatment and with penicillin so swift and effective, the case rates of syphilis and, to a lesser extent, those of gonorrhea underwent a rapid decline beginning in 1948 and continuing until 1956. In their enthusiasm, many physicians in clinical and public health medicine, who should have known better, proclaimed that gonorrhea and syphilis were defeated and no longer presented

a problem. Unfortunately, the unprecedented gains led physicians to lose sight of how the gains were accomplished. Consequently, budgets of public health medicine for the control of venereal disease were slashed to the point where the program became ineffectual. Many state health departments relying on Federal support either abandoned their programs when Federal funds were cut or assigned them to another and usually over-worked division. Without adequate appropriations for finding syphilis, no cases were found. This led to the erroneous idea that none existed and that, therefore, there was no problem. The integrated team of clinic and public health medicine was broken and the predictable rise in venereal disease incidence occurred in 1956.

Although public health medicine bears a responsibility for the rising rates of infectious syphilis, it shares it with the clinician because he too was lulled by premature optimism and complacency.

The therapeutic efficiency of penicillin has lulled some physicians into mental laziness. In some cases, a patient with a positive blood test was treated vigorously without benefit of diagnosis, the idea being that "if the patient has syphilis he will be cured, and if he doesn't, the treatment won't do any harm." Failure to diagnose, to take blood tests, and to think of syphilis in the differential diagnosis serves only to increase the reservoir in the community.

Next is the problem of interviewing patients for contacts. It is known that for every infected patient there should be at least one infected contact, the source of infection. Yet, in 1958, patients with diagnosed primary and secondary syphilis interviewed for contacts had an epidemiologic index of 0.5, which means that for every 2 cases of lesion syphilis, only one infected contact was found. Thus, half the time, even the source of the patient's infection could not be determined, let alone the people whom the patient himself had infected. How can syphilis be controlled when more than half the infected patients causing the disease are allowed to run around undetected in the community? Compounding this problem is the failure of private physicians to interview their patients for contacts. Understandably, the private physician is busy. He may not have time to interview, or even to bring in, the contacts for examination. However, he can arrange to have his patient quietly and diplomatically interviewed by the skilled and trained personnel of the health department.

Added to the problems of control is the population mobility so characteristic of the United States. In the course of a year, 4,000,000 to 5,000,000 people move from one state to another, and, roughly, an equal number within the state move from one county to another. Migrant laborers moving across vast sections of the country in search of seasonal agricultural work show consistently higher rates of infection than other segments of the population. No local surveillance mechanism can cope with a sudden epidemic covering a number of states. The rapidity with which the disease moves from area to area is indicated by a recent report that 9% of the contacts of civilian

patients and 36% of those of military patients resided outside the state in which they were exposed to the disease.

Sexually promiscuous persons are notoriously restless, moving quickly from area to area. The ease and speed of modern travel make it necessary to think of venereal disease control activities on a national rather than a state or sector level. States with good control programs are constantly being seeded from sister states with less adequate programs or no control programs at all. The problem in these less fortunate states is frequently that of money, a lack of which can be helped by the restoration of Federal assistance grants to the states for the benefit of all.

Members of the medical profession, then, need to adjust themselves to the fact that, although the syphilologist may be dying out, syphilis is not. The words of Neisser are just as appropriate now as they were 50 years ago when arsphenamine was introduced: "Human indolence and stupidity will arrange that syphilis will never die out, but will remain always a dangerous disease." (Fiumara, N. J., et al., Venereal Diseases Today: The New England J. Med., 260: 863-868, April 23, 1959)

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Percutaneous Renal Biopsy

Since the first practical method of renal biopsy by the percutaneous route was developed, at least 2000 cases have been recorded. Perhaps several times that number of biopsies have actually been performed. Although the percutaneous renal biopsy is well established as a research procedure, it is not so well established as an ordinary diagnostic procedure. This review discusses the use of the percutaneous renal biopsy as a diagnostic tool and the changes in concept of renal disease that have resulted from its use in investigation.

As with all operative procedures, the percutaneous renal biopsy carries certain risks. Even though local conditions vary widely, a limited evaluation of the risk is feasible. In at least 3 institutions, a series of 500 or more biopsies without mortality has been accumulated. In many other institutions, the percutaneous renal biopsy has been performed in 200 or more cases without mortality. On the other hand, several deaths have occurred on the first attempt or in a small series. It would appear that in experienced hands the risk of mortality should be less than 0.1%.

Morbidity has been experienced in almost every series. Hemorrhage of some degree probably occurs after every biopsy. In terminal or near terminal patients, an antemortem biopsy is accompanied by evidence of blood loss ranging from 10 to 50 ml. The local tissue forces in the region of the posterior aspect of the kidney seem capable of tamponade and control of this amount of bleeding. In most cases the only evidence of bleeding from

the biopsy site is the appearance of blood in the urine. Hematuria is usually microscopic in amount and persists no longer than 36 hours. Bleeding produced by transection of small arteries in the kidney has occasionally been observed. These hemorrhages usually halt spontaneously.

More serious accidents also occur. Occasionally, the needle has been known to penetrate the pelvis of the kidney. This is discovered by the reflux of urine through the biopsy needle or from recovery of mucosal tissue in the biopsy specimen. Although this would seem to be a serious event, it is usually uncomplicated unless the urinary tract is obstructed. Occasionally, the hilar vessels have been opened by the percutaneous needle. Bleeding from this source is potentially serious, especially if the renal vein is involved. Although bleeding from the hilar vessels is more serious than from others, hemorrhage from any source may be alarming. Hemorrhage has on occasion required operative intervention for control. The incidence of severe hemorrhage requiring some form of treatment (transfusion or surgery) has been surprisingly low.

Immediate or delayed pain occurs in a small number of patients. The pain may be either colicky or it may be constant and localized in the flank. Rarely is it severe.

The size or age of the patient also does not seem to limit the procedure. At least one patient of 450 pounds has been biopsied successfully. The percutaneous renal biopsy has been carried out successfully at every age from one year into the seventh decade. It is probable that at both ends of this age range, the risks are increased.

In addition to certain reservations in the selection of patients with hypertension, bleeding dyscrasias, et cetera, a careful study of the x-ray films of the kidney will probably prevent a small number of accidents that would occur because the kidney is in an abnormal location. A single kidney would seem to be sufficient cause for avoiding a biopsy. Also, it appears to be sound practice to carry out the procedure in the hospital and to keep the patient under observation and at bed rest for 48 hours subsequent to the biopsy.

Unless a patient is in uremia or in the nephrotic syndrome, the primary renal diseases are remarkably asymptomatic. Obviously, a patient with lupus nephritis may have other stigmata of systemic lupus erythematosus; a patient with the Kimmelstiel-Wilson lesion will probably have overt diabetes, but a large number—perhaps the majority of patients with primary renal disease who are accustomed to receive close medical attention—are discovered by routine urinalysis. This appears to be less true of children than of adults.

In a patient without signs or symptoms, there are relatively few abnormalities of the urine which help in formulating a specific diagnosis. Unfortunately, the list of such findings is short.

Red cell casts and hemoglobin casts have long been interpreted as indicating an acute glomerulitis. Albuminuria greater than 5 gm. per 24 hours

usually indicates one of the diseases capable of producing the nephrotic syndrome. This is also true of birefringent fat in cells and casts. Glitter cells are often associated with pyelonephritis. Papillae in the urine are a good, although rare, sign of acute necrotizing papillitis. Bacteria in a fresh clean urine suggest chronic pyelonephritis. Hemosiderin in cells suggests a form of renal siderosis.

Other laboratory findings in an asymptomatic patient are also of assistance. A high blood globulin points strongly to amyloid or systemic lupus; a low albumin suggests an early nephrotic syndrome and usually—although not invariably—limits the diagnosis to those diseases which produce this syndrome. The finding of L. E. cells suggests lupus. Longstanding chronic infection suggests amyloid. Most laboratory findings only suggest a renal disease; usually they do not establish a specific diagnosis.

Even patients with marked renal insufficiency and uremia and patients with the nephrotic syndrome may have little to suggest a specific diagnosis. Any one of a large number of disease entities may produce the nephrotic syndrome. A list of diseases producing the nephrotic syndrome should include lipid nephrosis, chronic glomerulonephritis, systemic lupus, diabetes mellitus, polyarteritis nodosa, renal vein thrombosis, amyloid disease, and certain drugs and toxins. The nephrotic syndrome has been reported to occur with other entities, but this occurs rarely and the possibility always exists that a primary renal disease of another sort has been overlooked. The pure lipid nephrosis, for instance, may be diagnosable only by the electron microscope. The renal biopsy is undoubtedly a justifiable diagnostic tool, although it has not yet reached full maturity in clinical practice. For most patients, the risks do not appear to be excessive. An added caution must be exercised in malignant hypertension, but even here, after careful appraisal of this added risk, the biopsy may still be justified. The experience of the operator would appear to modify some of the risk.

The biopsy has often added to the confusion surrounding a given case because it may be uninterpretable or because it provides an unfamiliar complex of findings. This result is becoming less common with increasing experience. Even when the histology of the kidney is not diagnostic, it may suggest something of clinical value about the nature of the disease process, such as the presence of vascular disease, focal nephritis, or tubular disease of unidentified nature. The use of the electron microscope has considerably extended the range of the percutaneous biopsy. It is unfortunate that the cost and complexity of this instrument have confined it to certain centers. It should be remembered also that a number of technical failures will occur and the sampling error may be large.

Despite these real problems, the percutaneous renal biopsy is often the only way of establishing a diagnosis and makes its greatest contribution in the appraisal of the asymptomatic patient with proteinuria and an abnormal urinary sediment. (Arnold, J. D., Spargo, B., Clinical Use of the Percutaneous Renal Biopsy: Circulation, XIX: 609-620, April 1959)

Management of the Bladder in Traumatic Paraplegia

The need for assiduous bladder care from the very beginning of paraplegia is of the utmost importance, and its unremitting continuance throughout the paraplegic's life should be emphasized. Many complications may be averted and rehabilitation of the patient greatly accelerated.

A patient with a recent cord injury should be on continuous bladder drainage with a self-retaining Foley catheter (5 cc. bag). It is important that the catheter be no larger than a Fr. 18 because of the danger of urethral fistula from pressure necrosis. In the event of urethral sepsis, drainage can more easily seep out around a small catheter.

The catheter requires careful attention. Syringe irrigation with sterile water or saline should be done daily to insure patency and keep bladder infection minimal. The procedure is done as aseptically as possible and the patient can be taught eventually to irrigate his own bladder. Tidal drainage has been advocated by others, but does not appear to have any special advantages. The catheter should be changed every 10 to 14 days even if there is no evidence of incrustations.

A bladder training program can be instituted while the patient is still in bed as soon as cystometric studies indicate that bladder activity has become reflex in type or vesical tone has been regained. The catheter is clamped for 1-1/2 hours at a time except at night. At the end of each of these periods, the clamp is released and the patient strains as in normal voiding. The fluid intake is adjusted so that no fluid is taken between the hours of 7:00 p. m. and 7:00 a. m., and one glass of water (250 cc.) is ingested hourly during the other 12 hours. After the patient is able to remain dry for a week without leakage around the catheter between emptyings, the interval should be increased to 2 hours. After this, the interval is increased to 2-1/2 hours, and then to 3 hours. Accumulation of more than 400 cc. in the bladder, however, should not be allowed to occur.

The catheter may be removed when the patient can stay dry for 3 hours without leaking around the catheter. It is advisable to postpone removal of the catheter until the patient is at least semiambulatory and able to strain more efficiently.

After removal of the catheter, the patient is instructed to void on schedule and regulate fluid intake as before. Urination is usually done in a sitting position. Some patients find thay can empty their bladder best by doing a "push-up," that is, by abdominal straining and suprapubic manual compression. After a time, they may find that they have some trigger area in the abdomen or thigh which, if touched or stroked, precipitates reflex micturition. The patient with a nonreflex bladder obviously cannot develop a conditioned voiding reflex and will have to rely on abdominal straining and Crede pressure to assure effective emptying. Residual urine is checked frequently during the first few weeks after catheter removal.

The amount of residual urine is dependent on a balance between the expulsive force of urination (detrusor contraction, abdominal straining, and manual compression) and the resistance at the bladder neck. If a high residual urine (more than 100 cc.) is present in spite of efficient expulsive forces, there must be either a mechanical or spastic obstruction at the vesical neck which should be relieved.

Transurethral resection producing a widening of the vesical neck has been of great benefit to many patients with large amounts of residual urine regardless of bladder type and even in the absence of demonstrable bladder neck obstruction. The procedure is generally not performed earlier that 8 months after injury. Removal of a ring of tissue or even a small resection of the anterior lip reduces the resistance encountered by the detrusor so that residual urine decreases.

Pudendal neurectomy has been considered as the best treatment for spastic sphincteric obstruction. Other procedures, such as intrathecal injection of alcohol, sacral rhizotomy, and cordectomy have also been recommended. Some of the procedures have the disadvantage of converting an upper motor to a lower motor neuron lesion and, therefore, abolish reflex detrusor contraction and generally weaken detrusor tone.

Some workers in the past have advocated treating the urinary infection in paraplegia only when clinical evidence of sepsis ensued. Routine medication was not advised because of the fear of drug resistance. Consequently, chronic infection has remained uncontrolled in a large number of paraplegics and probably is the main factor responsible for the observed high incidence of chronic pyelonephritis and renal insufficiency.

With the present availability of a wide variety of broad spectrum antibiotics and other efficacious chemotherapeutic agents, their prolonged administration in reduced dosage is probably advisable in much the same way that similar extended therapy has become acceptable in the treatment of rheumatic infection.

The incidence of calculus formation in the paraplegic individual is distressingly high, especially during the first 2 years after injury. As a consequence of lack of stress and strain upon the bony skeleton, large amounts of calcium and phosphorus are liberated from the bones and are swept into the urine where excessive excretions lead to stone formation.

Therapy is aimed to forestall calculus formation by preventing excessive supersaturation of the urine with calcium and phosphorus. It may be accomplished by diluting the concentrations of the implicated crystalloids, by reducing their total excretions, or by increasing their solubilities in the urine. The concentrations of stone-forming salts in the urine can be reduced most effectively by increasing urinary volume with forced fluids. A paraplegic patient should drink a minimum of 3 liters of water a day. The excretions of calcium and phosphorus in the urine may be decreased by dietary restrictions and the reduction of bone demineralization. Ingestion of milk and its products should be limited.

Vesicoureteral reflux is probably the major factor in the spread of infection to the kidneys among paraplegics. Unless satisfactory bladder drainage can be assured, reflux is also invariably followed by hydronephrosis. The latter, however, can occur with no demonstrable vesico-ureteral reflux.

A patient exhibiting vesicoureteral reflux should be carefully observed and intravenous pyelograms and cystograms performed every 3 months. Bladder training is contraindicated, and at the first evidence of hydronephrosis, a catheter should be inserted and straight bladder drainage instituted. Hydronephrosis with no associated vesicoureteral reflux is also treated by dependent continuous bladder drainage.

The paraplegic patient must be followed with the utmost vigilance for the rest of his life. It should be impressed upon him that his future well-being and chance of survival depend to a large extent upon his willingness to cooperate fully in the follow-up examinations. Intravenous pyelography and cystography should be made every year and residual urine measured every 6 months even when all appears to be going well. It should also be borne in mind that dangerous renal lesions may develop insidiously and a bladder that empties well is no guarantee for the permanency of good renal function. (Morales, P.A., Hotchkiss, R.S., Management of the Bladder in Traumatic Paraplegia: Arch. Phys. Med., 40: 141-148, April 1959)

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Treatment of Parosteal Osteoma of Bone

Parosteal osteoma occurs in both benign and malignant forms, with the malignant form a predominant feature of the disease. In 1951, the authors reported 16 cases as a new entity, histologically similar to myositis ossificans, but with a more intimate relationship to bone and having a graver prognosis. Jaffe and Selin, as well as Coley and Higinbotham, have briefly described a type of osteogenic sarcoma which has the features of the disease described in this report. More recently, Dwinnell, Dahlin, and Ghormley and Dahlin have written on this subject, preferring to designate the disease entity as "parosteal osteogenic sarcoma," thus emphasizing the growth potential or subsequent malignant changes noted in many of the cases studied. These authors reported 15 cases.

The relationship of the malignant phase of parosteal osteoma to a preceding benign growth appears to be an unusually intimate one. The initial lesion is most frequently a benign proliferation of ossifying fibrous tissue which results in a rounded bony mass projecting from the shaft of a long bone at, or near, the metaphyseal region. There is usually no base or pedicle of orderly bone growth, formed by the underlying normal bone and capped

by cartilaginous tissue as is often seen in osteochondromas or exostoses. Instead, the ossifying mass, by contiguity, eventually invades adjacent cortical and cancellous tissues at one or more points. The process also extends in an outward direction into the soft parts, often involving the muscles with or without a periosteal pseudo-encapsulating membrane. Islands of cartilage may be found within the ossifying mass intermingled with more direct ossification from fibrous tissue. The cartilage does not form a separate zone of superimposed tissue, such as occurs in osteochondromas. Therefore, it would appear that the benign phase of the tumor is characterized by ossifying fibrous tissue arising in the region of the periosteum of long bones—femur, tibia, fibula, humerus, ulna, and radius. The tumor shows a tendency to progressive growth and ultimate malignant change. The malignant phase of the process is akin in its histology to sclerosing osteogenic or fibrosarcoma. The evolution from benign to malignant forms often appears to be a gradual process extending over a number of years. The number of 5-year cures (60%) obtained in this group by resection or amputation is unusually high as compared with rates of survival among many other forms of bone sarcoma.

Parosteal osteomas occur most often in the first four decades of life; between the ages of 8 and 40 years. In 10 of 22 cases reported, the lesions were found on the posterior surface of the lower femur, bulging into the region of the popliteal space. Similar growths were observed about the upper femur, the upper and lower portions of the humerus, the upper ulna and radius, the upper fibula, and lower tibial regions. There were 12 females and 10 males among the patients studied.

A swelling or mass and local pain or tenderness were the outstanding clinical features. The duration of symptoms extended over a period of weeks to years. Ten patients had noticed a mass for one year or more. One patient had noticed an increasing enlargement of the lower thigh for 7 years. At times, progressive increase in the size of the mass was the only symptom. Apparently, trauma had not played a significant role in the development of these lesions, although in 3 patients it led to the discovery of the mass. In one patient, irradiation for skin disease preceded the bone lesion by 32 years.

On examination, a mass of bony hardness is felt which is firmly attached to the adjacent bone. The tumor extends into the soft parts and may involve muscle. The periphery of the bony mass is usually smooth in contour, although in a few cases it was found to be infiltrating. The slow growth of the tumor, its discrete character, and the normal appearance of the overlying soft parts suggest a relatively benign growth.

There are no systemic features, such as the leucocytosis and fever frequently seen in rapidly growing sarcoma of bone.

In the roentgenogram, the tumor is seen as a parosteal mass of ossifying tissue which involves the ends of long bones, but has its most prominent manifestations in the overlying soft parts. The tumor, in its early phases,

is visible as a dense irregular or rounded mass of new bone which is firmly attached to the cortex along a portion of its broad base, but is separated for most of its circumference from the underlying skeletal structures. There may be several discrete smaller masses. This is particularly true if recurrence has followed a previous operation. The underlying bone forms an irregular sclerosis suggesting a platform for the new growth through widening of the cortex and with some periosteal reaction. In late cases, the densly ossifying mass seems to envelop the underlying bone. In recurrent tumors following surgical excision, often after prolonged intervals, active and prominent medullary involvement may be seen with obvious roentgenographic features of malignant change. In view of the density of the osseous shadow and its size in primary cases, there is surprisingly little destruction or reaction in the adjacent bone. The diagnostic features of primary lesions are the density of the osseous mass, well delineated margins along one or more aspects of the periphery, and the occasional independent or discrete secondary osseous growths.

A review of 16 cases previously reported by the authors with the addition of 6 new cases emphasizes the fact that parosteal osteomas are potentially malignant lesions. At the initial operation, the specimen often may be chiseled away or resected with a portion of the underlying bone and may fail to show histologically malignant features on adequate examination.

Of the 22 cases studied, the original lesion appeared to be benign in 14 patients. Subsequent surgery, necessary for recrudescence of disease, revealed the tumor as benign in only 2 cases at the second operation. The tissue removed in the only or final operation was considered malignant in 15 patients, benign but cellular in 3 specimens, and typically benign in 4 instances.

The history of slow growth, the circumscribed character of the neoplasm at operation, and the benign histology of the excised mass may give the surgeon a false sense of security. The temptation is to consider these growths as atypical examples of myositis ossificans. The subsequent course of the disease, however, compels reevaluation. The irregular osseous surface of the cortex at the operative site, showing renewed or continued activity, presages the development of masses of irregular bone which penetrate into the adjacent soft parts. Eventually, the recurrent mass tends to surround and invade the bone in frankly sarcomatous fashion. From the standpoint of prognosis, 4 of the 22 cases were considered indeterminate.

The absolute 5-year survival rate proved to be 63.6%, while the adjusted 5-year survival rate was 60% in the patients treated. This latter rate does not include the indeterminate cases nor the patients who lived 5 years and subsequently died of their disease. Of those patients surviving 5 years or more without disease, the final operation was amputation in 6 cases and excision or resection in 5 cases. Two of the latter patients received x-ray therapy in addition to local removal of the tumor.

Of 18 determinate cases, 11 patients are living and well for 5 or more years (60%). In 8 of the 13 patients, the disease recurred after local excision or resection, resulting in amputation. Five of the 8 patients died of their disease, while 3 are living and well for 5 years or more. Three primary amputees are 5-year survivals without disease.

Bold ablative surgery by resection or amputation is necessary to cure parosteal osteoma in the majority of cases. If complete resection in a relatively inactive lesion can be accomplished, cure should result. There is no place for temporizing surgical excisions. If there is any question about adequate en bloc resection, then amputation is indicated. When pathologic changes show frank sarcoma, amputation is indicated at once. Recurrent cases with or without malignant manifestations, are best treated by amputation.

Care should be exercised not to confuse parosteal osteoma with osteogenic sarcoma situated predominantly in the periosteal zone of long bone structure. The differential diagnosis also includes atypical myositis ossificans, certain osetochondromas, and osteomas. (Copeland, M. M., Geschickter, C. F., The Treatment of Parosteal Osteoma of Bone: Surg. Gynec. & Obst., 108: 537-548, May 1959)

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Digitalis Intoxication

This article reemphasizes the varied clinical pictures produced by digitalis intoxication in the hope that morbidity and mortality of this iatrogenic disease may be reduced.

The clinical records and electrocardiograms of those patients discharged from the City of Memphis Hospitals with the diagnosis of digitalis intoxication in the years, 1940 through the first quarter of 1957, have been reviewed. The criteria used in confirming the diagnosis of digitalis intoxication in this review consisted of symptoms or electrocardiographic signs of digitalis intoxication which disappeared on omission of digitalis. In most cases, there was a definite history of ingestion or administration of excessive amounts of digitalis. One hundred and forty-eight cases were found to conform to these criteria.

Seventy-five cases were males and 73 were females. The racial incidence of intoxication with digitalis corresponded to the admissions from each racial group to this hospital. The youngest patient was 6 years old, the oldest, 96 years old. Approximately one-third of the cases occurred in patients in the seventh decade of life (31%); about one-fifth each were patients in their sixth and eighth decades (19.6 and 18.3%, respectively). The diagnosis was infrequently made (11 instances) in persons less than 40 years of age. The etiologic diagnoses of the heart disease under treatment conformed to the general incidence of these diagnoses at this institution.

The majority of patients in this series were in rather severe congestive failure; this is best shown by the fact that 117 patients (79%) were functionally in classes III and IV according to the New York Heart Association's classification.

Anorexia, nausea, and cardiac irregularities were almost equally frequent as the initial manifestation of digitalis intoxication in this series. The next most common sign of intoxication proved to be an increase in the severity of the congestive failure which improved when the digitalis preparation was withheld. The duration of intoxication prior to clinical recognition varied tremendously, i.e., from a few hours to several months. Not infrequently, the presence of other signs or symptoms of intoxication was required before a correct diagnosis could be made. In 7 patients (4.7%), one or more subjective manifestations were the sole changes produced by intoxication; in these cases, the diagnosis was clear only when the symptoms disappeared on withholding digitalis. Electrocardiographic changes alone indicated the presence of digitalis intoxication in 37 instances (25%). The great majority of patients, however, presented both signs and symptoms (104, or 70.3%). The symptoms and signs (including types of arrhythmia encountered) are presented in Tables. It is to be remembered that two or more arrhythmias (or conduction defects) frequently occurred in the same patient during the course of intoxication.

Digitalis leaf was by far the most frequent cause of toxicity in this series. Next most frequently producing intoxication was digitoxin, either alone or in combination with lanatoside C. Other preparations were found to be responsible only occasionally. It was found that an average maintenance dose of digitalis leaf (gr. 1.28 daily) frequently produced intoxication. When first manifestations of intoxication were correlated with the preparation used, it was found that 51% of the patients receiving purified preparations first suffered symptoms as compared with 68% of those receiving digitalis leaf, i.e., the patients receiving leaf more frequently experienced anorexia, nausea, or vomiting before the appearance of arrhythmias than did the patients on purified glycosides. Electrocardiographic changes or increase in failure was the initial manifestation of toxicity in 49% of patients on purified glycosides and in 32% of patients on leaf. Unless digitalis intoxication was recognized soon after its onset, there was no difference in the incidence of subjective and objective signs in cases taking leaf and in those taking purified glycosides. An attempt was made to ascertain whether there was any reason other than individual sensitivity for patients to become intoxicated on an "average" maintenance dose of digitalis. Uremia was found to be no more frequent in patients who became intoxicated on average doses of digitalis than in patients who received doses larger than average. The weight distribution of patients who became intoxicated on average doses of digitalis did not differ from the weight distribution of patients who became intoxicated on doses greater than average. The frequent use of mercurials, with or without marked weight loss, occurred with equal frequency in both groups.

In this series, the maximal duration of toxicity was 16 days in a patient whose arrhythmia, produced by digitoxin, was treated with quinidine. For the last 4 years, potassium chloride, either intravenously in a slow drip (20 to 40 mEq./hr.) or by mouth (4.0 to 8.0 gm. daily), has been routinely used as treatment. No case of intoxication persisted more than 6 days on this regimen; most arrhythmias disappeared in from hours to 2 days. Procainamide was occasionally used (orally or intravenously) with success.

Digitalis intoxication was thought to be the cause of death in 6 patients of this series. Autopsies were performed on 5 of these 6 patients, no anatomic cause for death could be demonstrated in any of the 5.

Digitalis intoxication occurs on any dosage. It is apparent that digitalis, like insulin, must be carefully fitted to the needs of each patient. Only by cautious trial and error with careful clinical and electrocardiographic observation of the patient can the digitalizing and maintenance doses be correctly determined in the individual. (von Capeller, D., Copeland, G. D., Stern, T. N., Digitalis Intoxication - A Clinical Report of 148 Cases: Ann. Int. Med., 50: 869-876, April 1959)

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Staphylococcal Pneumonia - Clinical Evaluation of Forty Cases

This is a report of further clinical investigation of staphylococcal pneumonia. Forty cases were diagnosed and treated in the U. S. Naval Hospital, St. Albans, N. Y., during a 20-month interval. Historically, they may be categorized as hospital and nonhospital acquired, with further description as follows:

(a) Complication of preexisting major disease,
(b) postinfluenzal, (c) postoperative, and
(d) occurrence in hospital personnel

Diagnostic features of history, physical findings and the patient's clinical appearance were utilized together with roentgenologic and bacteriologic findings to institute early decisive therapy. Emphasis was placed on personal examination of sputum smears, cultures and chest roentgenograms, and consultation with a mobilized "pneumonia team."

Early in this experience, it became evident that there were radiologic characteristics peculiar to staphylococcal pneumonia of high reliability in leading to diagnosis.

Analysis of antibiotic sensitivities revealed most of the encountered organisms to be resistant to the sulfonamides, tetracyclines, streptomycin, and penicillin. The best therapeutic results were obtained with ristocetin (26 cases). Vigorous supportive therapy included tracheostomy (21 cases). Gamma globulin was administered to 16 patients as adjunctive therapy.

During the course of their pneumonia, 8 patients died, 6 of whom had other lethal primary disease (metastatic carcinoma, lymphoma, etc.). Twelve patients had a significant fall in hemoglobin and hematocrit during their infections, 3 of whom became icteric; an additional 2 had icterus without change in hemoglobin. Twenty patients had a leukocyte count below 12,000 mm. at the time of diagnosis. Pulmonary complications encountered were pneumothorax, empyema, lung abscess, and tension cysts. Only 2 patients had significant respiratory disability after recovery.

Awareness of the manifestations and gravity of staphylococcal pneumonia, with attention to early diagnosis and decisive therapy, is emphasized as essential for the successful management of this disease. (L. R. Schumacher, LT MC USN, J. R. Coates, LT MC USN, R. C. Sowell, LT MC USN, and G. L. Calvy CAPT MC USN, Department of Medicine, U. S. Naval Hospital, St. Albans, N. Y.: Clin. Research, 7: 267, April 1959)

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Letter to the Surgeon General

The Surgeon General has extracted the following paragraphs from a letter recently received from a Rear Admiral USN. It points out the importance of taking the necessary time and trouble to explain to a patient—flag rank or enlisted—what you are doing, why you are doing it, and the meaning of your findings. This is good MEDICINE—most of us practice it, more of us should:

"Without detracting in any way from the thoroughness of the physical examinations which we, in the Navy, are given annually, I must say that I have never before been so completely satisfied in my own mind concerning the thoroughness of an examination. Additionally, Commander Sanborn spent a considerable amount of time explaining to me why they were doing what they were doing, what they were looking for and—in some cases—the meaning of what they found. I realize, of course, that it would be impractical for all officers in the Navy, even the most senior, to be put through such a series of examinations on a routine basis. However, Bart, I sincerely hope that you and your people will meet with every success in any attempt which you might make to expand the coverage given by this group at Pensacola.

To sum up then, I do want to express to you my appreciation for your personal interest in my case and to let you know what I think of the medical group in whose hands you placed me."

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Medical Symposiums for Fiscal Year 1960

Three Medical Symposiums (MWMS) (formerly SWMS) will be conducted at the Field Command, Armed Forces Special Weapons Project, Sandia Base, Albuquerque, N. M., for Fiscal Year 1960 as follows:

MWMS - 6..... 14-18 September 1959
MWMS - 7..... 16-20 November 1959
MWMS - 8..... 14-18 March 1960

The Navy has been allotted a quota of ten spaces for each course: Seven (7) spaces will be reserved for active duty career Medical officers; three (3) spaces will be reserved for inactive Reserve Medical officers.

TOP SECRET security clearance is required on all candidates approved for attendance.

Officers desiring to attend this course should submit a written request to the Bureau via their Commanding Officer. Requests must be received in the Bureau of Medicine and Surgery by the following dates for each course as indicated:

MWMS - 6..... 27 July 1959
MWMS - 7.....28 September 1959
MWMS - 8.....25 January 1960

All requests must indicate that a security clearance of TOP SECRET has been granted to the officer requesting attendance.

Successful candidates will be issued Temporary Additional Duty travel and per diem orders from this Bureau's training funds. (ProfDiv, BuMed)

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Environmental Sanitation Courses for Medical Service Warrant Officers

Applications are invited from Medical Service Warrant officers interested in assignment to duty under instruction in Environmental Sanitation at the University of California, Berkeley, Calif. This 5-month course, commencing in January 1960, consists of full-time academic training in general sanitation, medical statistics, vector control, venereal disease control, bacteriology, and communicable diseases. Successful completion leads to designation and assignment as Environmental Sanitation Officer.

Applications must be submitted to the Chief, Bureau of Medicine and Surgery via the chain of command, to reach the Bureau no later than 15 August 1959. The following information is required in each application: (1) Resume of academic background; (2) Obligated Service Agreement (as set forth in paragraph 8.a. of BuMed Instruction 1520.12)

It is highly desirable that a copy of all transcripts of formal college training be submitted with the application unless these have been furnished previously to the Bureau. (MSC Div, BuMed)

Medical Intelligence Reports
(Med-3820-1)

The attention of all Medical officers, particularly those serving at sea or on foreign shore, is invited to the requirements of Article 23-124, Manual of the Medical Department. Compliance with this article is of great importance to the Navy Medical Department and the Navy as a whole.

(ProfDiv, BuMed)

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IN MEMORIAM

RADM Clyde B. Camerer MC USN (Ret)	12 May 1959
CAPT Thomas M. Arrasmith MC USN (Ret)	4 March 1959
CAPT Walter P. Dey MC USN (Ret)	14 April 1959
CAPT Franklin F. Murdock MC USN (Ret)	3 April 1959
CAPT Wilfred M. Peberdy MC USN (Ret)	13 February 1959
CAPT Albert G. Wenzell MC USN (Ret)	4 April 1959
LCDR Charles H. Shifflette MSC USN (Ret)	15 April 1959
LT John E. Dumas MSC USN (Ret)	26 March 1959
ENS Lois M. Harkness NC USN (Ret)	13 February 1959
ENS Mary F. Spencer NC USN (Ret)	14 April 1959
WO Donald R. Haguewood HC USN (Ret)	27 April 1959

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From the Note Book

1. At the closing session of the Annual Aerospace Medical Association Meeting, the following Navy Medical officers were honored: CAPT C. P. Phoebus MC USN received the Theodore C. Lyster Award for outstanding achievement in the general field of Aviation Medicine. CAPT E. L. Beckman MC USN, Naval Aviator, was presented the Eric Liljencrantz Award for the best paper on basic research in the problem of acceleration. CAPT R. B. Lautzenheiser MC USN, CAPT F. K. Smith MC USN, and CAPT J. T. Smith MC USN were all elected Fellows of the Association for their outstanding contributions in the field of Aviation Medicine. CAPT O. W. Chenault MC USN was elected First Vice President of the Association for Fiscal Year 1960. He will be President Elect in 1961 and President in 1962. (TIO, BuMed)

2. LCDR Eggert Petersen, Coordinator of Psychological Training in the Royal Danish Navy, has begun a two-month orientation training visit to the United States to obtain first hand information on the U. S. Navy's psychological

program. He will become familiar with all phases of the Navy's preventive psychiatry program. Particular emphasis will be placed on aspects of the program pertaining to the selection and training of personnel. (TIO, BuMed)

3. LCDR J. E. Szakacs MC USN presented a paper entitled "Pathologic Implication of Catechol Amines" at the Seminar of the Surgical Physiology Section, Walter Reed Army Institute of Research, May 7, 1959. The data presented included the physiological effects and pathologic changes of controlled amounts of injected norepinephrine in the treatment of shock from the recent studies made by the speaker, by CDR R. M. Dimmette MC USN and CDR E. C. Cowart, Jr. MC USN, all attached to the U. S. Naval Medical School, NNMC, Bethesda, Md. (NavMedSchl, NNMC).

4. Under certain provisions of the law, commissioned officers in the U. S. Navy and Naval Reserve may be transferred to other U. S. military services. The Department of Defense Reorganization Act of 1958 made provision whereby the President of the United States may transfer any commissioned officer with his consent from the Army, Navy, Air Force, or Marine Corps, and appoint him in any other Armed Force. Bureau of Naval Personnel instructions 1120. 30 and 1120. 31 spell out the regulations in detail. (NavNews 95-59)

5. An "almost explosive extension" of disease prevention and medical care has taken place in the Soviet Union, but the quality of service falls short of that found in the United States. "The Report of the U. S. Public Health Mission to the Union of Soviet Socialist Republics" (PHS Pub. No. 649) contains the findings of a Mission of five doctors who visited the Soviet Union late in 1957 under the exchange program approved by the two countries in 1956. (PHS, HEW)

6. This article discusses the results of therapy in 102 patients with chronic lymphocytic leukemia, and in 118 patients with chronic granulocytic leukemia who were treated predominantly with radioactive phosphorus. The 5-year survival was 51% for chronic lymphocytic leukemia and only 12. 5% for chronic granulocytic leukemia. (Ann. Int. Med., April 1959; E. H. Reinhard, M. D., C. L. Neely, M. D., D. M. Samples, M. D.)

7. This article discusses a little known form of sarcoidosis in which polyarthritis is a conspicuous or dominant clinical finding. There is reason to believe that the joint disease is a manifestation of sarcoidosis and that it occurs more frequently than has been recognized. (New England J. Med., 23 April 1959; L. Sokoloff, M. D., J. J. Bunim, M. D.)

8. This report, based on 62 cases of endometrial carcinoma in which treatment consisted of the Wertheim hysterectomy, is presented as a critical study of the many factors underlying the management of this problem by a radical surgical approach. (Surg. Gynec. & Obst., May 1959; L. Parsons, M. D., F. Cesare, M. D.)

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DENTAL SECTION

Dental Officer Strength Down - Dental Procedures Up

During calendar year 1958, the strength of Navy Dental Corps officers declined from the calendar year 1957 average of 1799 to 1677, or 6.8%. However, the 7,474,929 dental procedures performed during 1958 represented a decline of only 4.6% below the 1957 total of 7,838,063. The average number of procedures performed per Dental officer in 1958 (4457) increased 2.3% over the 1957 average (4357).

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Nonadherence to Repair Contract

A contract was negotiated with the Midwest Dental Manufacturing Company early this year for the repair of higher speed belt driven handpieces manufactured by that company. A letter, dated February 10, 1959, from Chief, Bureau of Medicine and Surgery to All Ships and Stations Having Dental Personnel, included a copy of the contract and pertinent information for its implementation. The effective date of the contract was March 1, 1959.

Information received from the manufacturer indicates that some activities are returning handpieces for repair without adhering to the provisions of the contract. This action results in unnecessary correspondence and undue delays in the return of the repaired handpieces. Additional copies of the contract may be obtained from: Dental Materiel Officer, Field Branch, Bureau of Medicine and Surgery, Sands and Pearl Streets, Brooklyn 1, N. Y.

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Change of Address

Please forward requests for change of address for the News Letter to: Commanding Officer, U.S. Naval Medical School, National Naval Medical Center, Bethesda 14, Md., giving full name, rank, corps, and old and new addresses.

RESERVE SECTION

Medical Department Correspondence Courses

Purpose and Mission.

The correspondence course program of the Bureau of Medicine and Surgery is administered by the U. S. Naval Medical School, Bethesda, Md. It is designed for training Medical Department personnel in medical-military functions and responsibilities of the Navy Medical Service. The objective of the program is to enable Naval personnel, active or inactive, to enhance their knowledge and proficiency in duties of rank or rate through independent study during off-duty hours.

The training program provides Naval Reserve officers with additional means of earning nondisability retirement and promotion point credit; it gives Regular and Reserve Navy officer personnel an alternate method by which they may wholly or in part qualify for promotion. Evidence of satisfactory completion of specified correspondence courses will gain for the enrollee exemption from specific written examinations. Regular Navy enlisted personnel may use this method of training to qualify for advancement. Inactive Naval Reserve enlisted personnel may earn nondisability retirement points and become better qualified to perform their medical-military duties.

In general, study materials consist of official Naval regulations, and reference and training manuals. When specific textbooks are required, they are purchased by the Navy and supplied to the enrollee; these materials are supplemented by guides composed of special instructions and assignments. Because the assignments are study aids, questions are answered with the textbook open. A course may include from one to sixteen assignments.

Within the limits of medical application, the battery of available courses presents a wide choice for the enrollee. The courses include not only those related to specific duties of personnel, but those which will also broaden their knowledge of medical-military naval subjects and keep them abreast of new developments.

The Naval Medical School welcomes new participants in the Correspondence Training Program. Because the courses are currently provided for Regular and Reserve officers and enlisted personnel of the Medical Department of the Armed Forces, officers of the U. S. Public Health Service, and Foreign Armed Forces Medical Department personnel, an optimal distribution of naval training is thus attained. This total participation increases the availability of training material and promotes an excellent exchange of Medical Department training information and aids. This may give rise to a new source of technical assistance for the benefit and welfare of all Armed Forces in the preparation of future training programs.

Eligibility

Medical Department correspondence courses are available at no cost to Regular and Reserve officers, enlisted personnel of the Armed Forces, officers of the U. S. Public Health Service, and Foreign Armed Forces Medical Department personnel.

Application Instructions

The form, Application for Enrollment in Officer Correspondence Course, NavPers 992 (Rev 2/58 or later revision) should be completed and forwarded to the Commanding Officer, U. S. Naval Medical School, National Naval Medical Center, Bethesda 14, Md. The appropriate change in the "To" line in Box J of the application form should be made. These forms can be obtained from your Commanding Officer or from the respective District Headquarters.

Completed applications will be forwarded as follows:

1. If on active duty: via your Commanding Officer.
2. If on inactive duty and not in a training program under the cognizance of the Chief of Naval Air Reserve Training (CNART): via your Naval District Commandant.
3. If on inactive duty and in a training program under the cognizance of CNART: via the Commanding Officer of NAS or NARTU having responsibility for the training program.
4. If on inactive duty and residing in a foreign country: via (1) the local Naval Attache or Force Commander, if any, and (2) the command maintaining your service record (usually your home District Commandant).
5. Foreign Armed Forces Medical Department Personnel: in accordance with paragraph 348d, OpNavInst 4950.1B.

CAUTION! Do not send applications for enrollment in Medical Department correspondence courses to the U. S. Naval Correspondence Course Center, Naval Supply Depot, Scotia 2, N. Y. Such procedure delays the processing of the application by several weeks. Send to that address only applications for enrollment in courses administered by that Center.

Multiple Enrollment

Medical personnel may be enrolled in more than one Medical Department correspondence course at one time.

THE COURSES

Title and NavPers Number	Assignments	Points
Atomic Medicine NavPers 10701-A	8	24
Aviation Medicine Practice NavPers 10912-A	6	18

Title and NavPers Number	Assignments	Points
Blood Transfusion, Methods and Procedures NavPers 10998-1	8	24
Combat and Field Medicine Practice NavPers 10706-A	4	16
Control of Communicable Diseases in Man NavPers 10772	6	18
Hospital Food Service Management NavPers 10767	6	18
Hospital Personnel Administration NavPers 10734	5	15
Insect and Rodent Control NavPers 10705-A	2	6
Legal Medicine NavPers 10766	8	24
Low Temperature Sanitation and Cold Weather Medicine NavPers 10997-A	3	9
Manual of the Medical Department, Part I NavPers 10708-2	9	24
Manual of the Medical Department, Part II NavPers 10709-2	8	18
Medical Department Orientation NavPers 10953-A	2	6
Medical Service in Joint Oversea Operations NavPers 10769	2	6
Pharmacy and Materia Medica NavPers 10999-1	8	24
Physical Medicine in General Practice NavPers 10735	7	21

Title and NavPers Number	Assignments	Points
Radioisotopes in Medicine NavPers 10773	7	21
Submarine Medicine Practice NavPers 10707-A	6	18
Treatment of Chemical Warfare Casualties NavPers 10765	3	9
Tropical Medicine in the Field NavPers 10995	12	36

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Occupational Medicine

Common Errors in the Diagnosis of Plumbism

Today, few diseases are as easy to diagnose as industrially induced plumbism. The area of contact is not elusive, the symptoms of 99% of all cases are well defined and the laboratory results, when procured by efficient techniques, are generally conclusive. Little of this can be said of most occupational diseases.

As a preface to any remarks on the diagnosis of plumbism, it appears logical to accept this viewpoint, that whatever the present attitude may be towards the value of diagnosis in general medicine, it will be reflected in occupational medicine. That there has been a deterioration in the art of diagnosis is obvious; due, no doubt, to the profession's overwhelming interest in the spectacular. Down the hallway of medicine as one passes hatracks, a diagnostic hat is indifferently tossed without looking to see if it has landed on the right peg. Haste is made to a room on the door of which is emblazoned in gold letters, T-H-E-R-A-P-Y. Therein is to be found the drama of medicine, likely as not being televised to a palpitating public. Also, therein is found the means to cure a patient before a diagnosis is correctly established.

Still to be heard or read is the statement that plumbism is a protean disease. The tense of the verb should be changed to read "was a protean disease." Factors which once permitted months or years of exposure to undue concentrations of lead dust or fumes no longer exist. It would be extremely rare in the experience of any physician today to see an industrially induced

case of plumbism characterized by the neuromuscular syndrome or encephalitis. It is, therefore, erroneous to assign to modern day lead intoxication the bizarre findings perpetuated in the literature.

Errors in the diagnosis of plumbism arise out of an inadequate history, insufficient knowledge of occupational environment, and reliance upon laboratories whose experience and efficiency are not known. A common source of error arises out of faulty collection of materials as well as the interpretation of reports submitted by the laboratory. The figures presented by the report must be evaluated in relation to the history of exposure and the clinical picture. The author's conclusion is that plumbism is not difficult to diagnose if these common errors are avoided. (Johnstone, R. T., Common Errors in the Diagnosis of Plumbism: Indust. Med., 28: 126-133, March 1959)

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Evaluation of Blood Lead Analyses

The laboratory offers a number of tests and analyses which are useful in the diagnosis and control of lead poisoning. Each has its advantages and disadvantages. The stippled cell count, the basophilic aggregation test, and the urinary coproporphyrin determinations are simple and rapid, but they are not specific for lead poisoning because they indicate pathologic reaction in the body which may be due to other morbid states as well as to lead poisoning. Urinary and blood lead determinations possess the virtue of specificity for lead; however, the analytical procedures are time consuming and require considerable care and skill on the part of the analyst.

Urinary lead values show relatively large day to day variations, although they correlate well with lead intake. Because of this correlation and the ease of obtaining samples, urinary lead values are widely used as a biologic test for the monitoring of lead exposures to indicate the need for further clinical and environmental controls. The analysis of urine for lead is somewhat, but not significantly, less difficult than the similar analysis of blood. In general, the concentration of lead in blood is considered to be more closely related to the clinical diagnosis of lead poisoning than are urinary lead values. That other clinical signs and symptoms of lead intoxication may exist when there is no abnormal elevation of the blood lead and that such signs and symptoms may be absent when the blood lead concentrations are quite high is a recognized enigma. Because of this, the ultimate diagnosis of lead poisoning depends on the skill of the physician in assessing the significance of the combination of laboratory results along with signs and symptoms in each case. Nonetheless, the determination of lead in blood remains one of the most valuable tests for lead poisoning.

Concentrations above 0.08 milligram (mg) lead per 100 milliliters (ml) of whole blood are believed to be abnormal and indicative of unusual absorption of lead. Values of 0.05 or less mg/100 ml were reported in 75% of normal subjects.

Recent work favors the expression of milligrams or micrograms of lead per 100 grams (gm) of whole blood rather than the expression per 100 milliliters as previously used. Blood lead concentrations in excess of 0.06 to 0.08 mg/100 gm are unquestionably indicative of a greater than normal absorption of lead. Values as high as 0.12 mg/100 gm are not uncommon among some industrial workers and others having an abnormal exposure to lead. The diagnostic significance of elevated levels of lead in blood and their correlation with clinical lead poisoning are not as well established as are the normal range of values.

The lead in the blood is concentrated for the most part in or on the red blood cells. The proportion of lead in the serum increases with the total lead concentration in the blood.

The actual chemical form in which lead is transported in the blood has not been definitely established. Various suggestions are colloidal dilead phosphate, lead diphosphoglycerate, a lead albuminate, or other phosphate or organic lead complexes.

In the spring of 1958, the Occupational Health Program, U.S. Public Health Service, agreed to coordinate a project for the voluntary cooperative evaluation of analyses for lead in blood. A plan was drawn up for the submission to cooperating laboratories of several sets of blood samples with known amounts of added lead to be prepared by the Occupational Health Program laboratories for analysis. The principal objectives of the project were stated: (1)to secure a statistical appraisal of the general competence in this analytical diagnostic service, and (2) to provide participating laboratories with a controlled self-appraisal of their techniques of blood lead determinations.

Subsequently, the health officer of each State was requested to designate and to secure the participation of some clinical and industrial hygiene laboratories having responsibility for blood lead analyses in his State. The inclusion of every possible laboratory was neither anticipated nor intended as the project was conceived to evaluate the general level of analytic performance. It follows that should the study reveal serious inadequacies, further action should be taken by those laboratories to improve their methods and techniques. The first set of samples was prepared and mailed in duplicate to the 50 participating laboratories. The methods of analyses to be used by these laboratories were not specified. Each laboratory was asked to determine the lead in the samples by whatever procedure they would normally use.

Although the final results are not known, it is felt that this project to evaluate the analyses of lead in blood will prove to be very worthwhile and

will have a beneficial effect on the accuracy and reliability of blood lead analyses in general. Such an evaluation is a project which any laboratory or group of laboratories may carry out for their own benefit and information. Indeed, every laboratory doing determinations of blood lead values should appraise its techniques in this manner at reasonably frequent intervals. Such appraisal should certainly include the entire procedure on actual blood samples and not be content with analyses of aqueous solutions of known lead concentrations. The importance and the difficulties of blood lead determinations require such vigilance to prevent backsliding into unreliable or erroneous work. (Byers, D.H., An Evaluation of Blood Lead Analyses, Indust. Med., 28: 117-121, March 1959)

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Cadmium Poisoning

Recently, a few cases of acute cadmium poisoning were reported to the Bureau of Medicine and Surgery. These cases involved personnel engaged in oxy-acetylene flame cutting of cadmium coated steel torpedo warheads which had been junked. In view of the foregoing, it seems appropriate to review briefly the subject of cadmium poisoning.

Acute Cadmium Poisoning

In 1924, Legge reported 3 cases of cadmium poisoning, one of them fatal, in men in a paint factory where ingots of cadmium were melted during a period of 3 hours in a poorly ventilated room. All of the 3 men complained of dryness of the throat, headache, and nausea. The urine was colored brown. A necropsy on the man who died showed hyperemia of the bronchi, gastrointestinal tract, and kidneys. In 1942, Nasatir reported a fatal case. Death occurred on the fifth day after exposure to cadmium fume caused by burning off with an oxy-acetylene flame, deposits of metal containing a high percentage of cadmium. The symptoms consisted of a feeling of constriction of the chest, increasing dyspnea, and cough which became much worse before death.

Symptoms and Signs. In 1944, Spolyar and others wrote an extensive report on cases of cadmium poisoning resulting from flanging operations of cadmium-plated pipe. The resulting exposure to cadmium-oxide fume led to 5 cases, including one death. On the basis of the 59 cases reported up to that date, the mortality rate of industrial cadmium poisoning appears to be 15%. In 1948, Johnstone reported the case of a young Mexican laborer who was sent to the hospital following the use of an oxy-acetylene torch on the inside walls of a furnace in which cadmium residues had been recovered from scrap metal. The patient was extremely ill with severe dyspnea and exhaustion, and gave a history of headache, cough, and pain

in the chest. The temperature rose to 104° F., the pulse to 140 and the respiratory rate to 50. Patchy signs appeared in the chest and bronchopneumonia was revealed by x-rays. Cyanosis and increasing respiratory distress preceded death. At necropsy, the lungs showed confluent bronchopneumonia.

Mass Poisoning by Cadmium-Oxide Fume. In 1944, Ross described mass poisoning due to cadmium-oxide fume affecting 23 workers. Finely divided cadmium dust from a cadmium recovery chamber became ignited owing to redhot cigarette ash carelessly dropped by one of the workers. In a few minutes, the cadmium dust became incandescent and emitted clouds of cadmium-oxide fume. The victims complained of irritation of the eyes, headache, vertigo, dryness of the throat, cough, constriction of the chest, and weakness of the legs. Three hours later, a set of delayed effects was observed. These included shivering, sweating, nausea, epigastric pain, and dyspnea. No case was fatal.

Chronic Cadmium Poisoning

Chronic cadmium poisoning leads to loss of weight, cough, and dyspnea, together with gross pulmonary emphysema. The lungs may be so severely affected that they push the liver and spleen down, rendering them easily palpable in the abdomen. There is staining of the teeth in the form of a golden-yellow ring and a raised erythrocyte sedimentation rate. Baader, in 1951, suggested that the symptom complex of a running nose with soreness and prickling should be called cadmium rhinitis because it occurs so frequently. The sense of smell becomes impaired or abolished—cadmium anosmia—and in such cases there is usually atrophy of the nasal mucosa.

An Unusual Proteinuria. There is an unusual protein in the urine. Friberg, in 1951, investigated the proteinuria in a group of 43 men who had been employed from 9 to 34 years in an alkaline accumulator factory in Sweden. In the urine as tested with 25% nitric acid, protein was detected in 28 men; as tested with trichloracetic acid, it was detected in 35 men. The proteinuria was not demonstrable by the boiling test nor by picric acid. By electrophoretic analyses, the protein was shown to differ from ordinary urinary protein and to have a molecular weight between 20,000 and 30,000 Friberg suggests that these patients excrete in the urine cadmium linked with protein.

Morbid Anatomy and Histology. In a man aged 39 who had been exposed to cadmium dust for 8 years in an accumulator factory, Baader, in 1951, found at necropsy emaciation, chronic rhinitis with atrophy of the nasal mucosa, chronic vesicular emphysema, purulent bronchitis, and interstitial pneumonia. There was also nephrosis. Severe dilatation of the stomach was found together with several areas of segmental cylindrical distention and elongation, 8 to 12 centimeters long, in the jejunum.

Histological examination showed nuclear changes in the ganglion cells of the walls of the trachea and bronchi, together with similar changes in the ganglion cells of the plexuses of Auerbach and Meissner. No changes were found in any other nerve cells. Friberg, in 1951, exposed 25 rabbits to cadmium dust for 2 to 3 hours daily for a period of 7 to 9 months. Proteinuria was found in most of the animals after 6 months' exposure; the protein was of the same type as that found in the men employed in the accumulator factory. At necropsy, chronic rhinitis was found in 16 cases and tracheitis in 20. Chronic bronchitis and emphysema were present in all of the animals and nephrosis was found in the majority.

Preventive Treatment

When cadmium is heated, dangerous quantities of cadmium oxide are formed and volatilized. Therefore, in the smelting of cadmium ores, the welding of alloys and the firing of cadmium-plated metal, precautions should be taken to remove all fumes by means of adequate exhaust ventilation. It has been suggested that all cadmium-coated metal should bear a warning label. While this measure is effective for large pieces, it is somewhat difficult to insure that small objects so coated are labelled (Fairhall, 1946). Symptomatic treatment is directed specifically against pneumonia when it occurs. (Excerpt from test, The Diseases of Occupations, by Donald Hunter, M. D., F. R. C. P.)

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Heat Stress in Tropical Climates

During World War II, environmental physiologists conducted tests in laboratory hot rooms and in the field to determine the effect of heat on young men at work and at rest. Such studies led to improved fabrics and designs for hot weather clothing, established the importance of water and salt in preventing heat exhaustion, and provided indices for evaluating the combined effect of environmental and metabolic heat on military personnel.

Heat casualties still occur in unseasoned recruits undergoing summer training and in unacclimatized combat personnel rapidly moved to hot climates. There is also the problem of providing individual protection against enemy attack without imposing a further burden from climatic heat. These problems are discussed in this article.

Classification of Hot Climates

It is convenient to classify hot climates as "hot-dry" or "warm-humid." Into the former class falls the desert climate characterized by high air temperature during the day, low humidity, intense solar radiation, a wide diurnal variation in temperature, and scanty precipitation.

"Warm-humid" or "warm-moist" climate is typically represented by the tropical rain forest areas lying within latitudes of 10 or 20 degrees from the Equator. It is characterized by:

1. Air temperatures which are not excessive, the upper limit being 90° to 95° F., but the average relative humidity is 75% or higher.
2. High moisture content of the atmosphere which reduces its transparency to solar radiation, thereby reducing solar heat loads on man. Direct solar heat is, therefore, less of a problem than in the desert.
3. Little diurnal or seasonal variation in temperature and dew point.
4. Heavy precipitation, usually varying with the seasons.
5. Abundant vegetation providing ample shade and a favorable radiant environment.

Heat Balance in Tropical Climates

In temperate climates, about 50% of the heat produced by the body is lost through radiation to cooler surfaces in the surroundings, about 25% is lost by convection to the cooler air, and about 25% by evaporation from the skin by insensible perspiration and from the upper respiratory tract.

The human calorimeter at the Naval Medical Research Institute, National Naval Medical Center, Bethesda, Md., provides a graphic picture of heat output from the human body during work or rest at different environmental temperatures. Records show that, with increased heat production associated with work at moderate or high temperatures, the heat output rises from the resting level in an exponential manner, leveling off as the rate of heat loss finally balances the rate of heat production. Essentially, all of the extra heat is evaporative.

On stopping work, the return of heat output to the resting level is also exponential, but the reverse of that seen during the rise. There is a lag in recovery because it takes time for heat stored in the body during work to be dissipated.

This emphasizes the importance of rest periods alternating with work. These periods must be of sufficient duration to allow recovery to occur. In hot environments, recovery will be slower than in cool environments because the number of calories stored for a given work output will be greater, and dissipation of stored calories will be slower on return to rest.

Although humidity has not been studied as a separate variable in these human calorimeter tests, one can predict that, for an air temperature of 88° F. or above, the higher humidity will result in a greater extent of sweating over the body surface to provide enough evaporation to maintain heat balance. Although difficult to measure, the wetted area is greater in the humid heat of the tropics than in the same degree of dry heat in temperate zones. In other words, to maintain the same rate of evaporation in tropical heat, it is necessary that a greater proportion of the body surface be covered with sweat than in temperate climates. By the same token, sweating involving

100% of the body surface will occur at lower rates of work in the tropics than in less humid climates. Extensive and continuous sweating contributes to subject's sensations of discomfort and also to a high incidence of skin diseases.

Some Military Problems Relating to Tropical Heat Stress

Recruit Training. Heat stress imposed on trainees by a combination of hot weather and strenuous drills is a problem in peace time as well as during rapid mobilization for war. Nearly 200 deaths from heat stroke occurred in Army recruits at training centers within the United States during World War II. The individual chiefly at risk was an obese unseasoned recruit from a home in the north undergoing his first weeks of summer training in a southern state.

Since World War II, heat exhaustion and heat stroke have continued to be problems in recruit training. The extent of heat casualties is not adequately revealed by the number of cases admitted to the sick list, because for every admission there are approximately 10 cases of mild heat exhaustion treated in field dispensaries and returned to duty without being reported. Summer weather at the Marine Corps Recruit Depot, Parris Island, S. C., is similar in nature to tropical climates. During the summer of 1952, occurrence of heat casualties at Parris Island averaged over 50 per 10,000 per week. Five recruits died of heat stroke in the 4-year period, 1950 - 1953.

In 1954, a program for controlling heat casualties was introduced at Parris Island based on a policy of liberal water and salt intake, rational clothing practices, indoctrination of recruits and instructors in the elements of hot weather hygiene, and curtailment of strenuous activity during periods of high temperature and humidity. This brought about a striking reduction in incidence of heat casualties. On the basis of field studies conducted by the Bureau of Medicine and Surgery in 1954 - 1955, the program for controlling heat casualties was further modified in 1956. Since then, environmental heat stress has been expressed in terms of the Wet-Bulb Globe-Temperature Index of Yaglou (WBGT Index), which is derived from hourly readings of the natural wet bulb, black globe, and shade dry bulb temperatures weighted and added together as follows: 0.7 WB (wet bulb) + 0.2 GT (globe) + 0.1 DB (dry bulb). Significant correlation was previously demonstrated between this index and evaporative weight loss in Marine Corps trainees undertaking various summer exercises.

At index levels of 85° F. or above, strenuous training activities are suspended for recruits in their first 3 weeks of training. More seasoned recruits continue regular drills until the index reaches 88° F., or above. Special conditioning platoons have been established for obese recruits and others substandard in physical fitness. A breaking-in period is required during the first week for all recruits. Under current regulations, the outer shirt is discarded during hot weather drills. With the introduction of the modified regulations including the WBGT Index in 1956, incidence of heat

casualties showed a further significant reduction in incidence rate despite higher seasonal heat. Because the lower levels of heat stress apply only td recruits early in training, these gains have been accomplished at a lower cost in training time than under the former regulations.

Whether the WBGT Index can be used for regulating training in hot-dry climates is a question which may be answered in tests scheduled for this summer at a Marine Corps base in the desert region of California.

Lack of Acclimatization. Physical fitness alone does not provide protection from heat. A highly trained combat unit of Marines was flown from northern California to Korea in August 1950 during the battle of the Pusan perimeter. Although in top physical condition, they suffered many heat casualties.

A more recent experience occurred in July 1958 during the landing of four battalions of Marines in Lebanon. Effects of heat stress were obvious in these units. Fortunately, there was no hostile action ashore, otherwise the added heat load imposed by activity in combat would doubtless have increased the incidence of heat casualties.

In February 1959 when Operation Banyan Tree was conducted by the Army, an opportunity arose to study the effect on physically fit troops of a sudden change from a temperate to a tropical climate. A battle group of paratroopers from Fort Bragg, N. C., was flown to Panama where they parachuted to a drop zone near the Rio Hato and immediately engaged in strenuous combat exercises against a simulated aggressor. Measurements of body weight as well as urine analyses revealed significant degrees of dehydration and salt deficiency in the test subjects during the first 48 hours of the exercise. This was only a pilot study, but it indicates the need for further investigation of the physiological adjustments that occur during acclimatization.

Clothing and Protection Against Conventional and Nonconventional Weapons. In a tropical climate, any clothing whatever will interfere with evaporative cooling and thus impose an additional heat load. Hence, in the tropics, the least clothing is best from the standpoint of heat balance and comfort. Military personnel, however, are required to wear clothing not only for purposes of modesty, but also to provide protection from insects, from mechanical injury, and for camouflage. Studies in World War II led to the design of the present poplin tropical uniform which is readily permeable to water vapor, but woven tightly enough to give necessary protection from biting insects and skin abrasion.

At present, however, the aim is to build into the uniform protection against various weapons as well. These would include high velocity shell fragments, thermal and ionizing radiation, and chemical and biological agents.

The Marine Corps is currently conducting studies on the effect of wearing body armor on the ability to maintain heat balance under tropical conditions.

Similar tests have already been conducted by the Army in the desert. Under hot-dry conditions, armor interferes only slightly with body cooling. It is too early to give results of tests in tropical environments, but one can predict that the problem will be more serious than in the desert because armor will reduce the wetted area of the body from which evaporation can occur.

In case of radiological, chemical, and biological agents, the technical problems of providing protection without imposing an excessive heat load will be formidable. For the foot soldier fighting in hot climates, it would appear that some type of built-in cooling system will be required.

Chronic Effects of Tropical Heat. It has been recognized since the time of Hippocrates that deterioration in physical and mental performance occurs during long sojourns in tropical climates. This was observed among American soldiers in New Guinea and other tropical areas during World War II. Except for high incidence of skin diseases, however, it has not been possible to establish a physiological, nutritional, or biochemical basis for these changes or to establish that heat is the environmental factor chiefly concerned.

It is now generally believed that psychological factors related to monotony and also the lack of recreation and normal social activity are more important factors than climate.

Conclusions

1. Because of the high ambient vapor pressure in tropical climates, body cooling by evaporation of sweat is inefficient. This is the chief cause of tropical heat stress.
2. Important effects of tropical heat are reduced exercise tolerance and depletion of body salt and water through excessive sweating.
3. Through gradual exposure to heat and exercise, unacclimatized recruits can acquire heat tolerance without incurring high rates of heat casualties.
4. Lack of acclimatization in physically fit combat units may jeopardize the success of missions conducted in hot climates.
5. Technological developments are needed to resolve the present incompatibility between tropical clothing designed for comfort and tropical combat uniforms designed for protection against enemy attack.

(CDR D. Minard MC USN, Thermal Stress Branch)

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Policy

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